

900005

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
SUPERFUND DIVISION  
77 WEST JACKSON BOULEVARD  
CHICAGO, ILLINOIS 60604**

EPA Region 5 Records Ctr.



216836

**DATE:** May 21, 2004

**SUBJECT:** Soil Sampling Results, Himco Dump, Elkhart, Indiana

**FROM:** Larry Jensen, CHP  
Senior Health Physicist  
Field Services Section

**TO:** Gwen Massenburg  
Remedial Project Manager  
Remedial Response Section 5

On March 17, 2004, a radiation survey at the Himco Dump in Elkhart, Indiana, was made with you, myself and staff of the Indiana State Department of Health, Indoor and Radiologic Health Division. Gamma-ray count rates were generally similar, at background levels, over the site with the exception of two deposits of black material in a trench adjacent to County Road 10 (or Bristol Road). To determine the identity and concentration of the radioactive materials in these deposits, two soil samples were taken and sent to the U.S. Environmental Protection Agency's radiation laboratory (the National Air and Radiation Environmental Laboratory, NAREL) for gamma spectrometric analysis.

Results are shown in the Appendix. Radionuclides identified are those in the Uranium Decay Series, the Thorium Decay Series, and the Actinium Decay Series. These are all naturally occurring radioactive materials. Also identified were potassium-40, a naturally occurring radionuclide, and cesium-137, a remnant of atmospheric testing of nuclear weapons.

For the Uranium Decay Series, only one radionuclide was identified (lead-212). The lead-212 concentration is one that would be reasonable for normal soils \*. The absence of any other radionuclides in this series is uncommon. The Uranium Decay Series, and therefore lead-212, are always present in normal soils. Perhaps there has been some processing that removed constituents of this series.

\* The United Nations Scientific Committee on the Effects of Atomic Radiation, in their 1993 publication on page 65, Table 5, shows the Uranium Decay Series concentrations in soil range from 0.1 - 3.8 picocuries per gram.

It will be noted that lead-212 was detected in the first analysis of Sample #2, but not in the duplicate \* (see Table 2). After discussions with laboratory staff at NAREL, it is believed this is due to the low soil concentrations where small variations in counting results determine whether or not the radionuclide is identified by the software as present. The levels measured do not indicate lead-212 contamination.

For the Thorium Decay Series, all the normally expected radionuclides are present at levels that would be reasonable for normal soils (see Table 3). Sample #2 levels are higher than Sample #1 levels but not so high that they would not be out of the normal range in soils and rocks. Consequently, no Thorium Decay Series contamination is evident in the Himco Dump samples.

For the Actinium Decay Series (uranium-235) all the radionuclides detected would be expected for this decay series. Thorium-227 and radium-223 were detected, but not all the time. Sample #1 only showed radium-223. The recount of Sample #2 did not show either. It is believed that, as with lead-210, this lack of detection is due to the low soil concentrations where small variations in counting results determine whether or not the radionuclide is identified by the software as present.

The laboratory (NAREL) was also asked to specifically review the thorium-227 and radium-223 results because these are not concentrations normally seen unless uranium-235 has been slightly enriched and that was considered improbable. Enriched uranium-235 is very tightly controlled since it is used for nuclear power plant fuel and nuclear weapons. The laboratory believes that these numbers are not actually elevated and that their cause lies with low count rates from the samples and a shortcoming in the software. Consequently, no thorium-227 and radium-223 contamination is evident in these samples.

Although radon-219 was detected and measured, it is a difficult constituent to rely on because it is a gas and can easily be lost out of the sample container. Lead-211 is produced by radon-219 so if radon-219 is not reliable, neither will be lead-211. Therefore, these results should be discounted. No contamination is evident from the Actinium Decay Series data.

Overall, there is no evidence of contamination in these samples. The lack of Uranium Decay Series radionuclides is very uncommon and may indicate this material was processed.

# Duplicate means the same sample was counted a second time.

\* The United Nations Scientific Committee on the Effects of Atomic Radiation, in their 1993 publication on page 65, Table 5, reports Thorium Decay Series concentrations in soil range from 0.1 - 3.5 picocuries per gram.

## Appendix

Himco Dump, Elkhart, Indiana			
Uranium Decay Series			
	Sample #1 (pCi/g)	Sample #2 (pCi/g)	Sample #2 Duplicate (pCi/g)
Lead-212		1.22	
Thorium Decay Series			
Radium-228	0.957	1.87	1.69
Radium-224	0.559	1.47	1.53
Lead-212	0.980	1.86	1.83
Bismuth-212	0.999	1.93	1.79
Thallium-208	0.320	0.563	0.551
Thallium-208/.36	0.889	1.56	1.53
Actinium Decay Series			
Thorium-227		0.148	
Radium-223	0.0673	0.526	
Radon-219	0.0903	0.150	0.229
Lead-211		0.333	
Other Radionuclides			
Cesium-137	0.0244	0.0130	0.0124
Potassium-40	15.2	22.9	23.0



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF RADIATION AND INDOOR AIR  
National Air and Radiation Environmental Laboratory  
540 South Morris Avenue, Montgomery, AL 36115-2601  
(334) 270-3400

April 20, 2004

**MEMORANDUM**

**SUBJECT:** Radiochemical Results for  
HIMCO Dump Samples

**FROM:** John Griggs, Chief *John Griggs*  
Monitoring and Analytical Services Branch

**TO:** Larry Jensen, Health Physicist  
Region 5

Attached is a data package for gamma analysis of samples collected from the HIMCO Dump Site in Elkhart, IN. The samples constitute NAREL batch number 0400010.

Radiochemical analyses usually require the subtraction of an instrument background measurement from a gross sample measurement. Both values are positive, but when the sample activity is low, random variations in the two measurements can cause the gross value to be less than the background, resulting in a measured activity less than zero. Although negative activities have no physical significance, they do have statistical significance, as for example in the evaluation of trends or the comparison of two groups of samples.

For all analyses except gamma spectroscopy, it is the policy of NAREL to report results as generated, whether positive, negative, or zero, together with the 2-sigma measurement uncertainty and a sample-specific estimate of the minimum detectable concentration (MDC). The activity, uncertainty, and MDC are given in the same units. The activity and 2-sigma uncertainty for a radionuclide measured by gamma spectroscopy are reported only if the nuclide is detected; so, the results of gamma analyses are never zero or negative. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Co-60, Cs-137, I-131, K-40, Ra-226, and Ra-228. If one of these seven nuclides is undetected, NAREL reports it as "Not Detected," or "ND," and provides a sample-specific estimate of the MDC.

Specific information concerning all aspects of the radiological analysis of the samples is contained in the batch case narratives of the data packages. If you have any questions concerning the analytical results, please contact me at (334)270-3450.

**Attachments**

cc: Jack Barnette, Region 5, w/o attachments  
Steve Ostrodka, SF, Region 5, w/o attachments  
Mary Clark, (6601J), w/o attachments  
Ed Sensintaffar, NAREL

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES**

**REPORT OF SAMPLE DELIVERY GROUP #0400010**

Project: HIMCO DUMP  
Analysis Procedure: Gamma Spectrometry  
Date Reported: 04/15/2004

**SAMPLES**

NAREL Sample #	Client Sample ID	Type	Matrix	Date Collected	Date Received
A4.01624K	TRENCH E OF CDA, #1	SAM	SOIL	03/18/2004	04/02/2004
A4.01625L	TRENCH E OF CDA, #2	SAM	SOIL	03/18/2004	04/02/2004

**EXCEPTIONS**

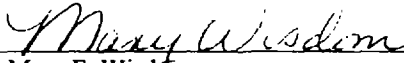
1. Packaging and Shipping - No problems were observed.
2. Documentation - No problems were observed.
3. Sample Preparation - No problems were encountered.
4. Analysis - No problems were encountered.
5. Holding Times - All holding times were met.

**QUALITY CONTROL**

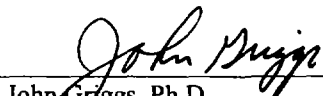
1. QC samples - All QC analysis results met NAREL acceptance criteria.
2. Instruments - Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.

**CERTIFICATION**

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Chief of the Monitoring and Analytical Services Branch and the NAREL Quality Assurance Coordinator, or their designees, as verified by the following signatures.

  
Mary F. Wisdom  
Quality Assurance Coordinator

4/20/04  
Date

  
John Griggs, Ph.D.  
Chief, Monitoring and Analytical Services Branch

4/19/04  
Date

## GENERAL INFORMATION

### SAMPLE TYPES

BLD	Blind sample
FBK	Field blank
SAM	Normal sample

### ANALYSIS QC TYPES

ANA	Normal analysis
DUP	Laboratory duplicate
LCS	Laboratory control sample (blank spike)
MS	Matrix spike
MSD	Matrix spike duplicate
RBK	Reagent blank

### QUALITY INDICATORS

RPD	Relative Percent Difference
%R	Percent Recovery
Z	Number of standard deviations by which a QC measurement differs from the expected value

### EVALUATION OF QC ANALYSES

A reagent blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "Z scores." A Z score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The Z score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The Z score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the Z score is computed.

Each standard uncertainty used to compute a Z score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of reagent blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

## GENERAL INFORMATION (CONTINUED)

### GAMMA ANALYSIS

The reporting format lists the gamma emitters in alphabetical order. The activity and 2-sigma uncertainty for radionuclides measured by gamma spectroscopy are reported only if the nuclide is detected. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Co-60, Cs-137, I-131, K-40, Ra-226 and Ra-228. If one of these seven nuclides is undetected, NAREL reports it as "Not Detected" or "ND", and provides a sample-specific estimate of the MDC.

Due to potential spectral interferences and other possible problems associated with the determination of the activity of certain radionuclides, the activities for Bi-214, Pb-214, Th-234, Pa-234m, Ra-226, Th-231, and U-235 are subject to greater possible uncertainty than other commonly reported radionuclides. It should be noted that this potential uncertainty is not included in the two-sigma counting uncertainty which is reported with each activity. Although in this report we do provide the calculated activities for these radionuclides, we recommend that the results be used only as a qualitative means of indicating the presence of these radionuclides and not as a quantitative measure of their concentration. The results for these nuclides are not used in the evaluation of quality control samples. Furthermore, because of mutual interference between Ra-226 and U-235, NAREL's gamma analysis software tends to overestimate the amounts of these nuclides whenever both are present in a sample. Lower estimates for Ra-226 activities can be obtained from the reported activities of its decay products, Pb-214 and Bi-214, which are likely to be somewhat less than the Ra-226 activity because of the potential escape of radon gas.

NAREL's gamma spectroscopy software corrects activities and MDCs for decay between collection and analysis, but only up to a limit of ten half-lives. So, if the decay time for a sample is more than ten half-lives of a radionuclide, that nuclide will almost always be undetected and the reported MDC will be meaningless. This is usually a problem only for short-lived radionuclides, such as I-131 and Ba-140, when there is a long delay between collection and analysis.



**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES  
SDG #0400010**

**ANALYSIS SUMMARY**

Analysis Procedure: NAREL GAM-01  
Title: Gamma Spectrometry

NAREL Sample #	QC Type	Preparation Procedure	Date Completed	Prep Batch #	QC Batch #
A4.01624K		N/A	04/08/2004	0008558W	0003210M
A4.01625L		N/A	04/08/2004	0008558W	0003210M
A4.01625L	DUP	N/A	04/10/2004	0008558W	0003210M

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES  
SDG #0400010**

**SAMPLE ANALYSIS REPORT**

Sample #:	A4.01624K	QC batch #:	0003210M
Matrix:	SOIL	Prep batch #:	0008558W
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.590e+03 GDRY	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
04/07/2004 12:44	1000.0	GE17	RCL

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Ba140	ND		9.7e-02	PCI/GDRY	03/18/2004
Bi212	9.99e-01	9.2e-02		PCI/GDRY	03/18/2004
Co60	ND		1.2e-02	PCI/GDRY	03/18/2004
Cs137	2.44e-02	5.1e-03		PCI/GDRY	03/18/2004
I131	ND		5.1e-02	PCI/GDRY	03/18/2004
K40	1.52e+01	8.7e-01		PCI/GDRY	03/18/2004
Pb212	9.80e-01	5.7e-02		PCI/GDRY	03/18/2004
Ra223	6.73e-02	3.1e-02		PCI/GDRY	03/18/2004
Ra224	5.59e-01	1.2e-01		PCI/GDRY	03/18/2004
Ra228	9.57e-01	5.7e-02		PCI/GDRY	03/18/2004
Rn219	9.03e-02	2.7e-02		PCI/GDRY	03/18/2004
Tl208	3.20e-01	1.9e-02		PCI/GDRY	03/18/2004

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES  
SDG #0400010**

**SAMPLE ANALYSIS REPORT**

Sample #:	A4.01625L	QC batch #:	0003210M
Matrix:	SOIL	Prep batch #:	0008558W
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.160e+03 GDRY	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
04/07/2004 12:45	1000.0	GE18	RCL

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Ba140	ND		1.2e-01	PCI/GDRY	03/18/2004
Bi212	1.93e+00	1.4e-01		PCI/GDRY	03/18/2004
Co60	ND		9.6e-03	PCI/GDRY	03/18/2004
Cs137	1.30e-02	6.0e-03		PCI/GDRY	03/18/2004
I131	ND		6.4e-02	PCI/GDRY	03/18/2004
K40	2.29e+01	1.3e+00		PCI/GDRY	03/18/2004
Pb210	1.22e+00	3.2e-01		PCI/GDRY	03/18/2004
Pb211	3.33e-01	2.2e-01		PCI/GDRY	03/18/2004
Pb212	1.86e+00	1.1e-01		PCI/GDRY	03/18/2004
Ra223	5.26e-01	5.2e-02		PCI/GDRY	03/18/2004
Ra224	1.47e+00	1.9e-01		PCI/GDRY	03/18/2004
Ra228	1.87e+00	1.1e-01		PCI/GDRY	03/18/2004
Rn219	1.50e-01	4.5e-02		PCI/GDRY	03/18/2004
Th227	1.48e-01	3.3e-02		PCI/GDRY	03/18/2004
Tl208	5.63e-01	3.3e-02		PCI/GDRY	03/18/2004

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES  
SDG #0400010**

**SAMPLE ANALYSIS REPORT**

Sample #:	A4.01625L	QC batch #:	0003210M
Matrix:	SOIL	Prep batch #:	0008558W
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.160e+03 GDRY	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	DUP

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
04/09/2004 15:10	1000.0	GE17	RCL

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Ba140	ND		1.4e-01	PCI/GDRY	03/18/2004
Bi212	1.79e+00	1.5e-01		PCI/GDRY	03/18/2004
Co60	ND		1.8e-02	PCI/GDRY	03/18/2004
Cs137	1.24e-02	6.5e-03		PCI/GDRY	03/18/2004
I131	ND		7.7e-02	PCI/GDRY	03/18/2004
K40	2.30e+01	1.3e+00		PCI/GDRY	03/18/2004
Pb212	1.83e+00	1.1e-01		PCI/GDRY	03/18/2004
Ra224	1.53e+00	2.0e-01		PCI/GDRY	03/18/2004
Ra228	1.69e+00	9.9e-02		PCI/GDRY	03/18/2004
Rn219	2.29e-01	6.2e-02		PCI/GDRY	03/18/2004
Tl208	5.51e-01	3.3e-02		PCI/GDRY	03/18/2004

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES  
SDG #0400010**

**QC BATCH SUMMARY**

QC batch #: 0003210M  
Preparation procedure: N/A  
Analysis procedure: NAREL GAM-01

NAREL Sample #	QC Type	Yield (%)	$\pm 2\sigma$ Uncertainty (%)	Analyst
A4.01624K		N/A		RCL
A4.01625L		N/A		RCL
A4.01625L	DUP	N/A		RCL

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**National Air and Radiation Environmental Laboratory  
QC Batch Report**

QC Batch #: 0003210M

Analytical Procedure: NAREL GAM-01

**LABORATORY DUPLICATES (PCI/GDRY)**

Sample ID	Nuclide	Original $\pm 2\sigma$	Duplicate $\pm 2\sigma$	RPD	Z
A4.01625L	BA140				
A4.01625L	BI212	1.93e+00 $\pm$ 1.4e-01	1.79e+00 $\pm$ 1.5e-01	7.53	-0.84 OK
A4.01625L	CO60				
A4.01625L	CS137	1.30e-02 $\pm$ 6.0e-03	1.24e-02 $\pm$ 6.5e-03	4.72	-0.13 OK
A4.01625L	I131				
A4.01625L	K40	2.29e+01 $\pm$ 1.3e+00	2.30e+01 $\pm$ 1.3e+00	0.44	0.05 OK
A4.01625L	PB212	1.86e+00 $\pm$ 1.1e-01	1.83e+00 $\pm$ 1.1e-01	1.63	-0.20 OK
A4.01625L	RA224	1.47e+00 $\pm$ 1.9e-01	1.53e+00 $\pm$ 2.0e-01	4.00	0.35 OK
A4.01625L	RA228	1.87e+00 $\pm$ 1.1e-01	1.69e+00 $\pm$ 9.9e-02	10.11	-1.23 OK
A4.01625L	RN219	1.50e-01 $\pm$ 4.5e-02	2.29e-01 $\pm$ 6.2e-02	41.69	1.94 OK
A4.01625L	TL208	5.63e-01 $\pm$ 3.3e-02	5.51e-01 $\pm$ 3.3e-02	2.15	-0.26 OK

Analyst:

Lowry, Robert C.

4-15-04

QA Officer:

Kim S. McLean

4/15/04